

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
OFFICE OF NEW REACTORS
WASHINGTON, DC 20555-0001

July 21, 2009

NRC INFORMATION NOTICE 2009-06: CONSTRUCTION-RELATED EXPERIENCE WITH
FLOOD PROTECTION FEATURES

ADDRESSEES

All holders of operating licenses for nuclear power reactors and fuel cycle facilities, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel; all current and potential applicants for an early site permit, combined license, or standard design certification for a nuclear power plant under the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants"; all current holders of and potential applicants for construction permits under 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to alert addressees of construction-related operating experience involving inadequate flood protection features. The NRC expects recipients to review the information for applicability to their facilities and to consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this IN are not NRC requirements; therefore, no specific action or written response is required.

DESCRIPTION OF CIRCUMSTANCES

Catawba Nuclear Station, Units 1 and 2 – Auxiliary Feedwater Pump Room Floor Drains

On January 30, 2008, at the Catawba Nuclear Station, the licensee declared the Unit 1 and Unit 2 auxiliary feedwater (AFW) pumps inoperable. The reason for this declaration was that a licensee engineer discovered, contrary to plant drawings, that a total of nine flow restrictor plates (three for Unit 1 and six for Unit 2) were missing in the drains, of the interior steamline and feedline penetration rooms, that route water to the floor drain sumps located in the AFW pump room of each unit. It appeared that this deficiency of the missing flow restrictor plates dated back to initial construction of the plant. The drawings called for each floor drain to have a flow restrictor plate with a 1.588 centimeters (5/8-inch) orifice. Calculations indicated that, with all the flow restrictor plates installed, the flow would be limited so as not to exceed the capacity of the AFW sump pumps following a postulated main feedwater line break in one of two steamline and feedline penetration rooms per unit. This problem of the missing flow restrictor plates was only with the interior steamline and feedline penetration room per unit, not the exterior one.

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The licensee also found that a historical calculation inappropriately assumed the following: (1) a non-conservative flood level and only two drains for each interior steamline and feedline penetration room, and (2) the availability of the floor drain sump pumps in each AFW pump room (which do not receive emergency power) to mitigate an event. Additional information is available in Catawba Licensee Event Report 50-413/2008-001, dated March 31, 2008, which can be found on the NRC's public Web site in the Agencywide Documents Access and Management System (ADAMS), under Accession No. [ML080940127](#).

Nogent, Units 1 and 2, in France – Flooding Caused by a Large Leak in a Condenser Circulating Water Pipe

On February 18, 2006, at the Nogent nuclear plant in France, a significant water leak in a pump's discharge piping occurred in the Unit 2 condenser circulating water system (CWS), train 1. The leak caused a pressure increase at the interface between the concrete foundation raft and the concrete floor in the Unit 2 turbine hall, and the turbine hall floor partly lifted about 10 to 12 centimeters (3.9 to 4.7 inches) higher than the foundation raft. The lifting of the turbine floor caused a misalignment of the manhole inlet and rupture of nearly all the 1.6 centimeters (0.63 inches) diameter floor-to-raft anchor rods distributed around the manhole inlet. Water flooded the Unit 2 turbine hall through the failed manhole, then flowed through a tunnel connecting the two units, and flooded the Unit 1 turbine hall. Both turbine halls were filled with water to a height of about 1 meter (3.28 feet). The water then spread from the tunnel between the units to the essential service water (ESW) system gallery through penetration sleeves. From the ESW gallery, the water entered the train A component cooling water pump room via a drain. The cause of the CWS manhole failure in Unit 2, train 1, was attributed to the specific construction of the manhole. In train 1, the manhole inlet and cover are bolted to the manhole's steel shell which is anchored to the turbine hall floor rather than concrete foundation raft. Therefore, the water was able to penetrate the interface between the floor and the foundation raft.

BACKGROUND

Applicable Regulatory Documents:

1. Regulatory Guide 1.59, Revision 2, "Design Basis Floods for Nuclear Power Plants" (ADAMS Accession No. [ML003740388](#)), dated August 1977, describes how nuclear power plants should be designed to prevent the loss of capability for cold shutdown and maintenance thereof resulting from the most severe flood conditions that can be reasonably predicted to occur at a site as a result of severe hydro-meteorological conditions, seismic activity, or both.
2. NUREG-1174, "Evaluation of Systems Interactions in Nuclear Power Plants," dated May 1989, describes technical findings related to unresolved safety issue A-17. Generic Issue 77, which was incorporated into the resolution of safety issue A-17, involved internal flooding in nuclear power plants.

3. NUREG-1055, "Improving Quality and the Assurance of Quality in the Design and Construction of Nuclear Power Plants" (ADAMS Accession No. [ML063000293](#)), dated May 1984, alerts addresses to the lessons learned during the construction of nuclear plants in the United States.

DISCUSSION

The operating experience discussed in this IN involves deficiencies in flood protection features that originated during construction. Such problems often stem from the failure to adequately translate the plant design basis requirements into the initial design. General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena," of Appendix A to 10 CFR 50, provides plant design requirements regarding the ability to withstand the effects of natural phenomena such as floods. In addition, the above Catawba example illustrates the importance of developing and implementing an effective change process as required by 10 CFR 50, Appendix B, Criterion III, "Design Control," during initial plant design and construction.

CONTACT

This information notice requires no specific action or written response. Please direct any questions about this matter to the technical contacts listed below.

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Note: NRC generic communications may be found on the NRC public Web site, <http://www.nrc.gov>, under Electronic Reading Room/Document Collections

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